United States Department of Agriculture | Forest Service | Monongahela National Forest Marlinton & White Sulphur Districts | PO Box 210 Marlinton, WV 24954 304-799-4334

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Subject: Release of Predatory Beetles and Trunk Injection of Hemlocks at Blue Bend Recreation Area

To: Forest Supervisor, File

This memorandum documents my decision to authorize the use of the predatory beetles *Sasajicymnus tusgae, Laricobius nigrinus, Scymnus sinuanodulus, and Scymnus ningshanensis* and trunk injection of selected hemlocks with an approved insecticide to control the exotic hemlock woolly adelgid *Adelges tsugae* (HWA) at the Blue Bend Recreation Area on the White Sulphur Ranger District. In addition I authorize branch sampling to monitor HWA populations in infested trees.

The Blue Bend Recreation Area is located along the Anthony Creek near Alvon, WV. The recreation area consists of a campground loop with 21 sites, a group camping loop with 18 sites, two picnic pavilions, 25 picnic sites, hiking trails, and a swimming area. The HWA is present and represents a serious threat to the hemlock trees within the recreation area. The hemlock trees are a major component of the tree cover in the campground areas and along the trails. Loss of these hemlocks would reduce the beauty and attractiveness of the area. Dead hemlocks in the recreation area would also jeopardize visitor safety. The cost of removing these hazard trees would put additional strain on limited recreation funds. Moving the recreation area would not be practical, as the river is part of the attractiveness of the area. The swimming area is located in a bend of Anthony Creek.

One aspect of the project includes the release of laboratory reared *Sasajicymnus tusgae, Laricobius nigrinus, Scymnus sinuanodulus, and Scymnus ningshanensis* in hemlock woolly adelgid-infested hemlock trees for the purpose of accelerating the establishment and evaluation of this predatory beetle in this area. The first beetle releases would be conducted sometime in Spring 2005. Monitoring and evaluation efforts would continue for three years after release for the purpose of documenting the establishment and dispersal of the beetle and evaluating its effectiveness in reducing HWA population densities and protecting hemlock health on a stand-level basis. The USDA Forest Service FHP personnel would be responsible for conducting the releases, monitoring beetle dispersal and changes in HWA population densities, conducting tree health assessments, and reporting their results. Additional beetles may be released within this site in the future based on beetle availability and monitoring results.

Sasajiscymnus tsugae

Sasajiscymnus tsugae [formerly *Pseudoscymnus tsugae*] is a tiny (~ 2 mm) coccinellid (ladybird) beetle native to Japan (Sasaji and McClure 1997). The life cycle of *S. tsugae* consists of the egg,

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four larval instars, the pupa, and the adult. Two overlapping generations per year are produced, and these coincide well with the two HWA generations. Adult and larval beetles feed on all life stages of the HWA (Hennessey and McClure 1995). Host suitability tests (tests that determine whether an agent can complete development and reproduce), choice feeding tests, and host acceptance tests (tests that determine whether an agent will feed or reproduce on a host) indicate that *S. tsugae* will feed on and develop on other adelgid species (McClure and Cheah 1998) along with feeding on the woolly alder aphid (*Prociphilus tesselatus*) (Butin et al. 2002).

Extensive laboratory and field tests in Connecticut have demonstrated that *S. tsugae* is an excellent natural enemy of HWA (Cheah 1998). Since 1995, over 1-million *S. tsugae* have been released in 15 eastern states (Cheah 2004, McClure and Cheah 2002), including the Fanny Bennett Tract, Falls of Hills Creek, and Bird Run Campground on the Monongahela National Forest.

Laricobius nigrinus

Laricobius nigrinus is a tiny (< 3 mm) Derodontidae beetle native to western North America (Zilahi-Balogh et al. 2002,). The life cyle of *L. nigrinus* consists of the egg, four larval instars, the pupa and the adult. One generation occurs per year. Adults become active in the early months of the fall and feed on HWA nymphs all winter. In late January, they begin laying eggs in the HWA wool sacs (ovisacs) and continue through June. The onset of egg laying coincides with the egg laying of the over-wintering generation of HWA (Zilahi-Balogh 2004). After hatching the larvae feed on the eggs of HWA. On completion of feeding, mature larvae drop to the ground and pupate in the soil at the base of the tree were they aestivate through the summer (Zilahi-Balogh 2004). The new generation of adults emerge from the soil in the early fall (Lamb 2003).

L. nigrinus has been found in close association with HWA on western hemlock in British Columbia, Washington, Oregon and Idaho where HWA is not considered a forestry pest (Zilahi-Balogh et al. 2003). *L. nigrinus* was imported into Virginia from British Columbia, Canada, in 1998. Host suitability tests and host acceptance tests indicate that *L. nigrinus* will feed on other adelgid species, but can only complete develop and reproduce on HWA (Zilahi-Balogh et al. 2002). Extensive laboratory and field tests in Virginia have demonstrated *L. nigrinus* to be an excellent natural enemy of HWA (Zilahi-Balogh et al. 2002). In 2003, *L. nigrinus* was released in seven eastern states, including the brushy mountain area on the Monongahela National Forest.

Scymnus sinuanodulus and Scymnus ningshanensis

Scymnus sinuanodulus and *Scymnus ningshaenesis* are both tiny (~ 2 mm) coccinellid (ladybird) beetles native to China (Butin et al. Montgomery 2001, Butin et al.2004). The two beetles are very similar in appearance and biology. The life cycle of these beetles consists of the egg, four larval instars, the pupa and the adult (Lu et al. 2002, Montgomery 2001). Both have only one generation per year (Montgomery 2001). Adult and beetles feed on all life stages of the HWA (Lu and Montgomery 2001, Butin et al. 2003); however, larvae (first instar) are specialist on eggs (Montgomery 2004). Host suitability tests (developmental tests), choice feeding tests, and host acceptance tests (behavioral test) indicate that both *S. ningshanesis* and *S. sinuanodulus* will

feed on and develop on other adelgid species (Butin et al 2004, Montgomery 2001) along with feeding on the woolly alder aphid (*Prociphilus tesselatus*) and other aphids (Butin et al. 2004, Montgomery 2001, Montgomery 2004).

This project would move forward with the release of *Sasajicymnus tusgae, Laricobius nigrinus, Scymnus sinuanodulus, and Scymnus ningshanensis* as a control for hemlock woolly adelgid. The goals and objectives of this study are listed below.

Project Objectives:

1. To introduce and establish predatory beetles in currently HWA infested hemlock stands.
2. To evaluate the impact predatory beetles have on HWA populations and to protect tree health at the stand level.

Long-term Goal:

To introduce and establish predatory beetles throughout the range of HWA, enhance the natural control of HWA in forest ecosystems, and reduce HWA impact on hemlock stands.

In addition, I have decided to go ahead with the use of trunk injected systemic insecticides to reduce hemlock woolly adelgid populations on moderately to highly infested trees. The trunk injection would be used on moderately to highly infested trees in the Blue Bend Recreation Area. The proposed treatment would first be conducted in the summer or fall of 2005, and consists of trunk injections of Imidacloprid, which is currently labeled for tree injection for the control of adelgids under the trade names Pointer®, Imi-jet® or Imicide®. Monitoring and evaluation efforts would continue for three years after treatment to document the effectiveness of treatment in reducing HWA population densities and protecting hemlock health on an individual tree basis. USDA Forest Service Forest Health Protection entomologists would provide a work plan with protocols to be followed for the 3-year project. Additional treatments within this site are possible in the future based on monitoring results. Branch sampling to monitor HWA populations in infested trees and treatment effectiveness would be done on some trees in the area. Branch sampling would consist of the taking five to six branches up to two to three feet long from each tree sampled.

Imidacloprid

Imidacloprid is a relatively new insecticide in the family of chemicals called neonicotinoids. It has a mode of action similar to that of the botanical product nicotine, functioning as a fast acting insect neurotoxicant that binds to the nicotinergic receptor sites in the postsynaptic membrane of the insect nerve, mimicking the action of acetylcholine, and thereby heightens then blocks the firing of the postsynaptic receptors with increasing doses. Because Imidacloprid is slowly degraded in the insect, it causes substantial disorder within the nervous system, leading in most cases to death.

Imidacloprid is considered to have low to moderate mammalian toxicity. Chronic (repeated dose) toxicity studies have demonstrated that imidacloprid is not carcinogenic, mutagenic and demonstrates no primary reproductive toxicity. In studies of metabolic fate in rats, imidacloprid was rapidly absorbed and eliminated in the excreta (90% of the dose with 24 hours), with little bioaccumulation (0.5% of the dose after 48 hours) with no biologically significant differences occurring between sexes, dose level and route of administration. The selectivity toxicity of imidacloprid is perhaps best illustrated by its use in flea treatments approved for cats and dogs. Advantage® is applied directly to the animal's skin; this preparation carries very little if any risk to the animal or to people, including children, who may handle the animal. Imidacloprid is an insecticide exhibiting both systemic and contact activity. The spectrum of activity primarily includes sucking insects (aphids, whiteflies, leaf and plant hoppers, thrips, plant bugs and scales), and also many Coleopteran species, and selected species of Diptera and Lepidoptera. Activity also has been demonstrated for ants (Hymenoptera), termites (Isoptera) and cockroaches, grasshoppers and crickets (Othroptera). No activity has been demonstrated against nematodes or spider mites. In spider mites, imidacloprid has been demonstrated to cause a breeding enhancement. Since spider mites can be a problem in hemlock, any imidacloprid treated trees should be carefully monitored for increases in mite populations.

Little is known of the biotransformation and bioactiviy of the metabolites of imidacloprid in plants. What is known is that trunk injected imidacloprid generally require a week or longer to provide adelgid control, with protection lasting for up to two years.

The HWA is an exotic forest pest that was first reported in the western U.S. in the 1920s and in the eastern U.S. in the 1950s. Today, the range of the HWA is spreading at a rapid rate, and is causing extensive hemlock decline and tree mortality in hemlock forests throughout the East.

The adelgid feeds on plant fluids and can kill a mature tree in about five to seven years depending on other environmental stresses. The tiny insect feeds on all life stages of the hemlock, from seedling to mature old growth tree. The adelgid is moved by wind, birds, or mammals. It has the potential to infest the entire range of eastern hemlock in the next 30 years. Existing natural enemies capable of maintaining low level HWA populations are nonexistent in North America. Management of HWA populations requires the establishment of biological control agents to successfully reduce the impacts of HWA on hemlock in the forest environment. Chemical control of HWA is not a practical option for hemlocks within the general forest because of their dispersed locations. Predatory beetles may provide lasting and effective control in a cost efficient manner.

A letter describing this administrative study was mailed out to interested individuals, organizations and government agencies on the Marlinton and White Sulphur Districts scoping lists on February 2, 2005. A legal notice was published in the Pocahontas Times on February 10, 2005. The Districts received response comments from two sources. Some concerns about the use of imidacloprid and the release of beetles were expressed. Issues related to the release of beetles and the use of insecticides include the following:

Could the predatory beetles impact other native predators or parasites that rely on HWA as a food source?

There are no known parasites of HWA in either this country or their country of origin. There are no other arthropod species federally or state listed as endangered or threatened that utilize HWA as a food source; hence, no such species will be affected by the release of *S. tsugae, L. nigrinus, S. sinuanodulus,* or *S. ningshanensis*.

Of the native or introduced beetles found in the natural hemlock habitat, none appear to be dependent on HWA and all have an alternate host preference. Beetle predators sometimes found associated with hemlock habitat include: twicestabbed lady beetle *Chilochorus stigma* which predates on hemlock scales; Halloween beetle *Harmonia axyridis* which primarily feeds on aphids but will opportunistically feed on adelgid; *Scymnus suturalis*, a common predator of the *Pineus* sp. but will occasionally be found feeding on HWA; and *Laricobius rubidus*, a derodontid beetle that feeds primarily on *Pineus strobi* on white pine but will also feed on HWA. Brown lacewing, midge and syrphid larvae have also been observed in association with HWA in Connecticut but in low numbers; these larvae are sometimes associated with egg masses of the HWA at low densities but all are generalists and prey on mites, aphids and other insect larvae. None of these predators either individually or collectively have a substantial impact on HWA populations.

Could these predatory beetles utilize alternative food sources? If they are able to adapt to other food sources, then impacts on native arthropods will be of concern.

Studies conducted at the Connecticut Agricultural Experiment Station by Dr. Mark McClure have indicated that *S. tsugae* is highly host specific and given the opportunity to move from HWA onto another potential host species *S. tsugae* continues to feed upon HWA. This information was collected in both the native range of *S. tsugae*, as well as, field and laboratory studies here in the U.S. The ability of the beetle to locate prey in a very efficient manner even at very low densities indicates that *S. tsugae* is specifically adapted to feed on HWA. These types of specialized adaptations seldom occur in predators which attack a broad range of prey species. *L. nigrinus* has a narrow host range and based on the work by Zilshi-Balogh et al. 2002 was only able to complete its development on HWA and is an adelgid specialist. *L. nigrinus* populations are expected to decrease as HWA densities decline. Other species of scymnine lady beetles, including *S. ningshanesis* and *S. sinuanodulus,* have already been introduced into this country as biological controls and have had no adverse impacts on non-targets. Examples of such introductions are *Diomus* and *Nephus spp.* to control citrus mealybugs. It should also be noted that of the other half dozen adelgid species already found in the U.S. only one is native and they are all forest pests causing impact to there host species.

Could any of the introduced predators become a nuisance to human habitations?

Behavioral studies indicate that *S. tsugae, L. nigrinus, S. sinuanodulus*, and *S. ningshanensis* do not aggregate in large numbers (McClure and Cheah 1998, Salom et al. 2000, Montgomery 2001, Zilahi-Balogh 2004), as was the case with another non-indigenous lady beetle, *Harmonia axyridis* that was introduced into the U.S. for biological control of aphids. This beetle became a nuisance because its natural behavior is to overwinter in aggregations in caves, hollow trees and other large, closed in structures (Montgomery 2001).

Could trunk or soil injections of Imidacloprid impact other non-target organisms?

Yes, because imidacloprid is effective against a wide range of insect species any sap feeding, or foliage feeding insect, or insect predator or parasite feeding on these insects, along with deer, insectivorous and sap feeding birds, etc that feeds directly on the foliage sap, or seeds of a treated hemlock tree will be exposed to the effects of this insecticide.

In studies with red-winged blackbirds and brown-headed cowbirds, it was observed that birds learned to avoid Imadacloprid treated seeds after experiencing transitory gastrointestinal distress (retching) and ataxia (loss of coordination). It was concluded that the risk of dietary exposure to birds via treated seeds was minimal. There is the possibility that insectivorous birds could be exposed to Imidacloprid, but the overall small number of trees being treated minimizes this possibility. Also, I have decided not to perform the soil injections at this time.

Could trunk or soil injections of Imidacloprid contaminate ground water along Anthony Creek?

Yes. To summarize the knowledge gathered to date concerning the fate of imidacloprid in the terrestrial environment it becomes evident that this compound is both mobile and persistent (US EPA 1994). Although this contamination is limited (based on the method of application and by the amount of material applied) because of the continuous processes of plant uptake, biotic degradation, photochemical (exposure to light) degradation and the binding to soil and organic matter, ultimately leading to the formation of carbon dioxide and bound residuals (Krohn and Hellpointer 2002).

Water solubility and vapor pressure are two of the most important properties driving environmental distribution of a compound. Imidacloprid has a high water solubility (510 mg/l) and very low vapor pressure (1.9 x 10-9 mm Hg), so it is unlikely to evaporate from soil or plant tissues and become an air contaminant (Felsot 2001b). On the other hand, its biodegradation rate (speed of breakdown by soil bacteria, plants and animals) in soil has been characterized as not very rapid (persistence in soil allows for continual availability for uptake by the plant), with a half-life of in the range of 27 days to a year in different soil types (US EPA 1994, Krohn and Hellpointner 2002). This persistence has raised a few concerns about ground water contamination. Subsequent studies have indicated that imidacloprid remains in the root zone and is only partially translocated into soil layers below 12 inches deep (Krohn and Hellpointer 2002) indicating the low potential for bioaccumulation in the environment (Bacey). Nevertheless, the EPA has reported that groundwater monitoring turned up residuals of imidacloprid of 0.1-0.2 ppb (parts per billion) in California and Michigan, and 1.9 ppb in Long Island, New York. While such levels indicate a need to better manage how imidacloprid is used, they are hundreds to thousands of times lower then the levels the Environmental Protection Agency (EPA) said it would be concerned about (Felsot 2002b).

Though imidacloprid is not intended for use directly to water or to areas where surface water is present the potential exists that it may move into Anthony Creek through soil injection. Imidacloprid does not persist in aqueous environments (Krohn and Hellpointer 2002) but in toxicity studies has been shown to be slightly toxic to fish and moderately toxic to aquatic invertebrates (US EPA 1994). For most of the aquatic species tested, imidacloprid falls into the

EPA's category of practically nontoxic LC50 (lethal concentration to 50 % tested animals) greater than 100,000 ppb to slightly toxic (LC50 between 10,000 and 100,000 ppb) (Felsot 2001a). In studies were imidacloprid was exposed to light, it had a half-life of one hour in water (US EPA 1994). Thus photo-degradation is regarded as an important elimination process for all aqueous solutions of imidacloprid (Krohn and Hellpointer 2002). Since more detailed analysis is desirable before using soil injection of imidacloprid in this area I have decided to use the trunk injection method for all trees to be treated with insecticides. I have decided against using soil injections at this time.

By using trunk injection as our application method, we greatly reduce the potential for ground water contamination by creating a nearly closed treatment system. Imidacloprid taken up by the tree's transport system is expected to move upward and downward within the tree (Tattar and Tattar 1999) but remain sequestered in the tree's tissue and not be available on the surface of roots, wood, or leaves (USDA Animal and Plant Health Inspection Service 2002). Since imidacloprid and its metabolites are sequestered in the tree's tissue any needles, or woody debris from treated trees that falls into the Anthony Creek will contain low concentration of insecticide.

Could trunk injections of Imidacloprid impact or damage trees?

Yes, trunk injections sever xylem cells, breaks the continuity of the water column at the area of injection, introduces air into cells, and initiates a wound healing response in the tree and can create a port of entry for decay and disease. Fortunately, hemlock has no aggressive stem diseases and very few heart rots (decay) that attack living trees, and of the fungi that do attack hemlock these are considered weakly or nonparthenogenic.

How would branch sampling affect the aesthetics of the area?

Branch sampling would be done on trees at each area. Five to six branch ends up to two to three feet long would be taken from each tree sampled. Overall the change in appearance of sampled trees should be negligible. Some may notice some cut ends on limbs, but most hemlock limbs are longer than three feet. Therefore even the sampled limbs would still retain green branches. Also, since hemlock trees generally have a large number of limbs the cutting of five to six branches from any particular tree should be easily masked by the uncut limbs.

This action is consistent with the Monongahela National Forest Land and Resource Management Plan, as amended, as it relates to research and forest pest management (Forest Plan, pp. 30, 92). While the plan does not specifically address HWA, it calls for research to determine silvicultural treatments to reduce adverse effects from gypsy moth, another introduced insect (Forest Plan, p. 30). General forest direction in the plan calls for the use of integrated pest management strategies to minimize or prevent the development of pest problems (Forest Plan, p. 92).

The project falls under Category 3, Section 31.1a (FSH 1909.15) of actions which may be categorically excluded from documentation in an environmental impact statement or environmental assessment. Category 3 includes "Inventories, research activities, and studies such as resource inventories and routine data collection when such actions are clearly limited in context and intensity." It also falls under Category 5, Section 31.1b (FSH 1909.15) which includes "repair and maintenance of recreation sites and facilities." This category can include

the use of insecticides to control insects at a recreation site. Direction provided in Forest Service Handbook *Environmental Policy and Procedures Handbook* 1909.15 (Interim Directive 1909.15-2002-2, effective 08/23/2002) requires the Responsible Official to consider whether extraordinary circumstances related to a proposed action warrant analysis in an EA or EIS. The Interim ID also states that the mere presence of these resources does not preclude use of a categorical exclusion. I analyzed this project for the following resource conditions (per FSH 1090.15, Section 30.3) and the results are as follows:

a. Federally listed threatened or endangered species or designated critical habitat, species proposed for Federal listing or proposed critical habitat, or Forest Service sensitive species:

Field surveys and a biological evaluation were completed and available in the District project file. There are no federally listed threatened or endangered species or their designated critical habitat within the project area with the exception of Indiana bat, which can occur in any generally forested area within the Monongahela National Forest. The BE concludes there will be no effect on the Indiana bat or any other listed or proposed T&E species. Some Forest Service sensitive species or their habitat may occur in the study area but the study will have no effect on species viability or lead to a trend towards federal listing. The U.S Fish and Wildlife Service concurs with this finding.

b. Flood plains, wetlands, or municipal watersheds:

Although the area lies within the floodplain of Anthony Creek, there should be no effects on the floodplain other than the maintenance of the hemlock forest cover within the recreation area. Without this treatment, the hemlock cover would be lost resulting in the loss of shade and the likely rise in water temperature of Anthony Creek. There are no wetlands of municipal watersheds within the recreation area.

c. Congressionally designated areas, such as wilderness, wilderness study areas, or national recreation areas:

The project area is not within or adjacent to any congressionally designated areas, so there would be no effects on any Congressionally designated areas.

d. Inventoried roadless areas:

The project area is not within an inventoried roadless area, so there would be no effect on roadless areas.

e. Research natural areas:

The project area is not within a research natural area, so there would be no effect on any research natural areas.

f. American Indians and Alaska Native religious or cultural sites:

No American Indian religious or cultural sites exist in the project area, so there would be no effect on any American Indian religious or cultural sites.

g. Archaeological sites, or historic properties or areas:

The study does not involve ground-disturbing activities; therefore, the study would not affect archaeological sites or historic properties.

Based on the above analysis, I have decided there are no extraordinary circumstances which would cause any significant impact on the environment and I am therefore categorically excluding this decision from documentation in an Environmental Impact Statement, Environmental Assessment or Decision Memo. Pursuant to CFR 215.8(a)(4), this decision is not subject to a higher level of review. Implementation of this decision may begin immediately.

Rondi Fischer

RONDI FISCHER
District Ranger